Each newly discovered one is of interest and perhaps a note should be made of the occurrence of a rather large dike recently found. It has been exposed at the eastern side of the Portland cement quarry east of Shurger Point, six miles north of Ithaca. It is the first of the Ithaca region dikes found in limestone and is exposed for the height of the Tully limestone at the north and south walls of the quarry and in the shales along the quarry bed.

No contact action was noticed. In places there is a thin calcite streak at the side of the dike, in others there is a tight contact between dike and wall rock. Striæ on the calcite gave evidence of horizontal movement. The dike varies in width from 11″ to 18″ and is decidedly green, due to the serpentine in it. It strikes about N 3° E., parallel to the dip joints, like all the dikes near Ithaca. There may be some connection between this dike and a group of smaller dikes east of Ludlowville, two miles to the north.

PEARL SHELDON

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THE HAWAIIAN OLONA

TO THE EDITOR OF SCIENCE: In SCIENCE[1] for September 10, 1920, p. 240, Mr. Vaughan MacCaughey again calls attention to the remarkably durable fiber of the Hawaiian Oloná, and quotes Dr. N. Russel's rather inaccurate account of the people making the fiber and its products, fish nets and cords, some used especially for fish-lines. In view of the possible importance of this product, it seems worth while to correct certain statements. The name of the bird caught for its yellow feathers was O-o not O-u. As late as 1864, when the present writer first visited the Hawaiian Islands, there were some natives at Olaa still beating the mamake kapa and twisting the oloná fiber on their thighs. On the island of Molokai, as late as 1889 a photograph was taken of a native scraping the fiber. Surely Mr. MacCaughey must be aware that in the Bishop Museum in Honolulu, is a fine cast from life of a native preparing this fine fiber, and there are many specimens of both the raw material, the finished product and the *laau kahioloná* or scraper which was sometimes a shell *papaua* (*Meleagrina margaritifera*) but more commonly a sharpened bone from the back of the *honu*, a sea turtle not a (fish, as Dr. Russel has it). The boards were made of any hard wood; the *naou* of Dr. Russel was perhaps the *naio*, or bastard sandalwood.

As a specimen of the remarkable durability of the fiber, there is in the Bishop Museum a ball of fish-line used by the Kamehamehas for a hundred years and it is still in perfect condition.

WILLIAM T. BRIGHAM

[1] N. S., Vol. LII., No. 1341.

QUOTATIONS

PROFESSOR MICHELSON ON THE APPLICATION OF INTERFERENCE METHODS TO ASTRONOMICAL MEASUREMENTS

THE first information Professor A. S. Eddington, Plumian professor of astronomy at Cambridge University, received that his theoretical deductions concerning the angular diameters of certain stars and of the Betelgeuse, in particular, had been confirmed by Professor Michelson [in his paper at the Chicago meeting] was from a cable message from the *New York Times*. He was extremely interested and delighted at the results obtained and is anxiously awaiting full details.

Talking to the *New York Times* correspondent he pointed out that many years ago Professor Michelson suggested a plan for measuring, at any rate to a much greater degree of accuracy than before, diameters of stars by the wave theory of light.

"For some time now," he said, "they have been carrying on these experiments at Mount Wilson, and I presume that it is there that these most interesting results have been obtained. The great difficulty that they have had to contend with has, of course, been what is known as atmospheric tremor. They have been trying Michelson's methods and previously had obtained some very interesting results, but these were only with regard to very close double stars. By this means they got some very successful results with double stars, but when they

came to try to determine the angular diameter of stars they were up against a very much more difficult problem. I knew that they were working on these lines, but this is the first word I have heard of the results.

"At a meeting of the British Association I delivered a presidential address to the mathematical and physical sections, and made reference to the fact that this experiment which was being carried out would be of the very greatest importance. We have of course had theories, and, working on those theories, I gave a table of what I thought would be the angular diameter of certain stars, and I am delighted to find that the figures so nearly correspond. This would seem to show the theories have been on the right side.

"In particular, I noticed that Betelguese's diameter is 260,000,000 miles, which is enormously larger than the sun. That is a very interesting confirmation of the theory of Russell and Hertzsprung of giant and dwarf stars, giving direct evidence that Betelguese is one of the inflated stars and very different from the sun."

Dr. A. C. Crommelin, chief of staff of the Greenwich Observatory, was interviewed today on Professor Michelson's discovery by *The Evening Standard* and expressed the interest the experts in England's principal observatory took in it.

"Star diameters have been calculated hitherto," he said, "but have never before been actually measured. Michelson's announcement that he has measured Alpha Orionis and found it to have a diameter of 260,000,000 miles, 300 times bigger than the sun, is hopeful.

"That the distance from the earth of such a star as Alpha Orionis, which is 900,000,000,000,000 miles away, should have been measured so long ago and the size of the star should remain unmeasured seems strange, but it was explained at the offices of the Royal Astronomical Society that the two measurements have to proceed on entirely different lines.

"The Astronomical Society confirms Dr. Crommelin in the expectation of good results from Professor Michelson's work. For some time past he and his work have loomed increasingly large in the astronomical world.—Cablegram to the *New York Times*.

CAUSES OF CLIMATIC OSCILLATIONS IN PREHISTORIC TIME, PARTICULARLY IN THE ICE AGE[1]

In 1918 Professor Arldt, of Radeberg, grouped the theories and weighed the evidence which had been proposed by 117 scientists in the past sixty years on the causes of the glacial and interglacial epochs. As none of these hypotheses are in all respects satisfactory, in his opinion, or can claim to explain thoroughly all paleo-climatic phenomena, he does not recognize any one theory or group of them. This is not surprising since the fundamental conclusions underlying these hypothesis have not been reached.

In this paper of twenty-seven pages, Arldt does not give an exhaustive explanation of the numerous hypotheses which have been proposed but a brief statement concerning the most important groups among them. He distinguishes two classes, Cosmic and Telluric, with three subdivisions for the first: Universal, Solar and Telluro-Cosmic; and five for the second: Dislocation of the Poles, Atmospheric, Intra-Telluric, Actologic and Orographic. Although discussions and opinions are to be found under each of these headings, his main contribution appears in crystallized but abbreviated form in his conclusion, thus:

> Among numerous theories explaining the changes in climate of the earth, those should be given preference which are based upon the hypothesis that the factors which are of importance to-day in determining climate have always been effective. . . . Most importance is attached to Ramsay's theory which emphasizes most strongly the direct and indirect action of the mountains. Besides these orogenetic forces other elements, as enumerated below, probably aided in the generation of the ice ages.
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> 1. The rise of extensive mountains (Ramsay).
> 2. The formation of ocean basins (Arldt).
> 3. The sinking of the entire ocean floor and the

[1] Theodore Arldt, "Die Ursachen der Klimaschwankungen der Vorzeit, besonders der Eiszeiten," *Zeitschrift für Gletscherkunde*, Band XI., s. 1–27, 1918.